PATENT SPECIFICATION

870,937

NO DRAWINGS.

Inventors:—NORMAN FOSTER and JOHN CHARLES COLLINS.

Date of filing Complete Specification : Aug. 6, 1958.

Application Date : Aug. 26, 1957. No. 26889/57.

Complete Specification Published : June 21, 1961.

Index at Acceptance :—

Classes 87(2), C1E1 ; **(2)5,** R2(A : C5 : C6 : C13 : C16 : G : H), R29(A : C5 : C6 : C13 : C16 : G) ; **22,** D(2 : 3 : 5), DX, N3(A2C : B3 : B9A) ; **96,** B(2A : 2B : 5 : 11A : 13F : 13I1 : 13IX : 13X) ; **and 140,** A(2C : 5C : 5G1A : 5G1B : 5H : 13 : 17).

International Classification :—B29b. B29d. C04b. C08g. C09k. D21h.

COMPLETE SPECIFICATION.

A Method of Producing Sheet Material from Glass Fibre, Gypsum Plaster and Aminoplast Resin.

We, GYPROC PRODUCTS LIMITED, a British Company, of Westfield, Upper Singlewell Road, Gravesend, Kent, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method of producing a stiff sheet material suitable for use for example in the formation of panels, tiles, ceiling and wall boards and like structural sheet elements, and to the material produced by such method.

According to the present invention there is provided a method of producing stiff sheet material from glass fibre, gypsum plaster and aminoplast resin comprising the steps of forming a mixture of calcium sulphate hemihydrate, chopped glass fibre in an amount lying between 6 and 7.2% of the total weight of the mixture and between 23 and 100% of the weight of hemihydrate present, water, a foaming agent, a water-miscible aminoplast resin precondensate and a hardener therefor, shaping the mixture to form a sheet and subjecting the formed sheet to heat to remove surplus water and cure the resin. The mixture may be shaped, for example, by moulding, casting, or rolling.

The alpha form of the calcium sulphate hemihydrate is preferred for use in carrying out the invention.

In some cases a layer of felted glass fibre may be applied to one or both sides of the sheet during the shaping of the mix to sheet form.

The aminoplast resin used may be of any kind of which the precondensate will be miscible with the water in the mix, and as examples may be mentioned urea-formaldehyde and melamine-formaldehyde.

Any commercially available foamable surface-active agent may be used as a foaming agent, such as the sodium alkyl sulphate in aqueous solution as sold under the Registered Trade Mark "Teepol". The resin hardener when used may be any acidic salt, such as ammonium chloride or aluminium sulphate, or a dilute mineral acid such as hydrochloric acid.

The following is one example of a mix made up in preparation for the production of the sheet material:—

Alpha calcium sulphate hemihydrate	60	parts by	weight
Urea-formaldehyde precondensate liquor, 60% solids	80	"	" "
Chopped glass fibre (length $\frac{1}{4}$"—$\frac{3}{4}$" 0.64—1.92 cm.)	15	"	" "
Water	50	"	" "
Foaming agent	1	"	" "
Resin hardener	4	"	" "

The mixture may be introduced into a conventional mixing machine e.g. of the paddle type and after intimate mixing is poured or extruded into a mould or other shaping means where light pressure and heat are applied to remove surplus water and cure the synthetic resin.

The material from the mixer may be discharged between two travelling layers of felted glass tissue and passed between pinch rollers and beneath an ironing belt where the sandwich is caused to take the form of a sheet of required thickness and the sheet as formed being taken by a conveyor through a kiln where surplus water is removed and the bonding synthetic resin cured.

The material can be produced as a continuous sheet of widely varying thickness, the most useful thicknesses in practice lying between ¼" and 1" (0.64 cm. and 2.54 cm.).

The sheet material is highly fire-resistant and sheets made from a sample mix as described above subjected to the tests described in B.S.S. 476, Part 1, 1953, "Fire tests on building materials and structures", is incombustible and possesses Class 1 surfaces for spread of flame.

The stiff sheet material prepared with the chopped glass fibre used within the range indicated by the above described limits is of low density e.g. having a weight between 16 and 36 lb. per cubic foot (0.26 and 0.58 g/cm³). It is of high breaking strength, and is also found to present high resistance to deflection or sagging even under conditions of high humidity. Its thermal conductivity, varying with differences in density, is found to be within the range 0.6—1.0 B.Th.U. in/ft² h. °F. (0.865—1.44 × 10^{-3} J cm/cm² sec. °C.).

WHAT WE CLAIM IS:—

1. A method of producing stiff sheet material from glass fibre, gypsum plaster and aminoplast resin comprising the steps of forming a mixture of calcium sulphate hemihydrate, chopped glass fibre in an amount lying between 6 and 7.2% of the total weight of the mixture and between 23 and 100% of the weight of hemihydrate present, water, a foaming agent, a water miscible aminoplast resin precondensate, and a hardener therefor, shaping the mixture to form a sheet and subjecting the formed sheet to heat to remove surplus water and cure the resin.

2. A method according to Claim 1 or 2 wherein the calcium sulphate hemihydrate is in the alpha form.

3. A method according to Claim 1 or 2 in which a layer of felted glass fibre is applied to one or both sides of the sheet during the shaping of the mix to sheet form.

4. A method according to any of the preceding claims wherein the resin is a urea-formaldehyde or melamine-formaldehyde resin.

5. A stiff sheet material produced by a method according to any one of the preceding claims.

REDDIE & GROSE,
Agents for the Applicants,
6 Bream's Buildings,
London, E.C.4.

PROVISIONAL SPECIFICATION.

A Method of Producing Sheet Material from Glass Fibre, Gypsum Plaster and Aminoplast Resin.

We, GYPROC PRODUCTS LIMITED, a British Company, of Westfield, Upper Singlewell Road, Gravesend, Kent, do hereby declare this invention to be described in the following statement:—

The present invention relates to a method of producing a stiff sheet material suitable for use for example in the formation of panels, tiles, ceiling and wall boards and like structural sheet elements, and to the material produced by such method.

The method of producing a stiff sheet material according to the present invention consists in forming a mixture of chopped fibre-glass, calcium sulphate hemihydrate, water and an amine-aldehyde resin as a bonding agent, moulding, casting, rolling or otherwise shaping the mix and subjecting to heat to remove surplus water and cure the resin.

The alpha form of the calcium sulphate hemihydrate is preferred for use in carrying out the invention and the mix also includes small proportions of a foaming agent and a resin hardener.

In some cases a layer of felted glass fibre may be applied to one or both sides of the sheet during the shaping of the mix to sheet form.

In order to obtain a product of adequate strength it has been found desirable to maintain the content of the chopped fibre-glass in the mix between a lower limit of 6 per cent of the total weight of the materials in the mix but not less than 23 per cent by weight of the calcium sulphate hemihydrate present and an upper limit of 25 per cent of the total weight of the materials in the mix but not more than 100 per cent by weight of the calcium sulphate hemihydrate present.

The amine-aldehyde resin used may be of any kind, and as examples may be mentioned urea formaldehyde and melamine formaldehyde, and which will be miscible with the water in the mix.

Any of the commercially available surface-active agents may be used as a foaming agent, such as the sodium alkyl sulphate in aqueous solution as sold under the Registered Trade Mark "Teepol". The resin hardener when used may be any acid salt, such as ammonium chloride or aluminium sulphate, or a dilute mineral acid such as hydrochloric acid.

The following is one example of a mix made up in a preparation for the production of the sheet material:—

Alpha calcium sulphate hemihydrate	60 parts by weight
Urea formaldehyde resin	80 „ „ „
Chopped glass fibre (length $\frac{1}{2}$"—$\frac{3}{4}$")	15 „ „ „
Water	50 „ „ „
Foaming agent	1 „ „ „
Resin hardener	4 „ „ „

The mixture may be introduced into a conventional mixing machine e.g. of the paddle type and after intimate mixing being poured or extruded into a mould or other shaping means where light pressure and heat are applied to remove surplus water and cure the synthetic resin.

The material from the mixer may be discharged between two travelling layers of felted glass tissue and passed between pinch rollers and beneath an ironing belt where the sandwich is caused to take the form of a sheet of required thickness and the sheet as formed being taken by a conveyor through a kiln where surplus water is removed and the bonding synthetic resin cured.

The material can be produced as a continuous sheet of widely varying thickness, the most useful thickness in practice lying between $\frac{1}{4}$" and 1".

The sheet material is highly fire-resistant and sheets made from a sample mix as described above subjected to the tests described in B.S.S. 476, Part I, 1953, "Fire tests on building materials and structures", is incombustible and possesses Class 1 surfaces for spread of flame.

The stiff sheet material prepared with the chopped fibre glass used within the range indicated by the above described limits is of low density e.g. having a weight between 16 and 36 lb. per cubic foot. It is of high breaking strength and is also found to present high resistance to deflection or sagging even under conditions of high humidity and its thermal conductivity varying with differences in density is found to be within the range 0.6—1.0 Btu. in/ft² hr. °F.

REDDIE & GROSE,
Agents for the Applicants,
6 Bream's Buildings,
London, E.C.4.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1961.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.